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EXAMINER

LEE, HSIEN MING

ART UNIT PAPER NUMBER

2823

DATE MAILED: 11/13/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/802,864

Applicant(s)

PENDSE, RAJENDRA D.

Examiner

Hsien-Ming Lee

Art Unit

2823

-- **Th MAILING DATE of this communication appears on the cover sheet with the correspondence address --**
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 25 August 2003.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-35 is/are pending in the application.
- 4a) Of the above claim(s) 10-17 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-9 and 18-35 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s) _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

Remarks

1. The objection to specification and drawing are withdrawn.
2. Claims 22-35 are newly added. Thus, claims 1-9 and 18-35 are pending in the application.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1, 3, 22 and 24 are rejected under 35 U.S.C. 102(b) as being anticipated by Caillat (US 5,879,530).

In re claims 1, 3, Caillat, in Fig. 7A-7C and related text, teaches the claimed method for forming a flip chip interconnect structure, comprising:

- providing a first member 10/60 and 12/62 on an IC chip 4 and a second member 54/52/44/56/6 on a substrate 2, the first member 10/60 and 12/62 comprising a deformable material 60 and 62 (i.e. Ni-Au alloy, col. 5, lines 35-39) having a low yield strength and a high elongation to failure and the second member 54/52/44/56/6 having surface asperities 52/54 on a surface on a part of the second member 54/52/44/56/6 to be bonded with the first member 10/60 and 12/62 (Fig. 7B), and
- bring the first member 10/60 and 12/62 into contact with the surface on the second member 54/52/44/56/6 and pressing the first 10/60 and 12/62 and the second

members 54/52/44/56/6 against one another using a force sufficient to cause plastic flow of part of the first member 10/60 and 12/62 into the surface asperities on the second member 54/52/44/56/6 (Figs. 7C).

In re claims 22 and 24, method for forming a flip chip interconnection structure, comprising:

- providing a first member 10/60 and 12/62 on an IC chip 4 and a second member 54/52/44/56/6 on a substrate 2, the first member comprising a deformable material 60 and 62 (i.e. Ni-Au alloy, col. 5, lines 35-39) having a low yield strength and a high elongation to failure and the second member 54/52/44/56/6 having a surface adjacent an edge on a part of the second member 54/52/44/56/6 to be bonded with the first member 10/60 and 12/62 (Fig. 7B); and
- bringing the first member 10/60 and 12/62 into contact with the second member 54/52/44/56/6 surface and pressing the first 10/60 and 12/62 and second 54/52/44/56/6 members against one another using a force sufficient to cause plastic flow of part of the first member around the edge (Fig. 7C).

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. Claims 1, 2, 4, 7-9, 18-23, 25, 28-35 are rejected under 35 U.S.C. 102(e) as being anticipated by Capote et al. (US 6,335,571).

In re claims 1-2, 4, 7, 8, Capote et al., in Figs 10-27 and related text, teaches the claimed method for forming a flip chip interconnect structure, comprising:

- providing a first member 108 on an IC chip 100 and a second member 106, which is a surface pad having a plated finish, on a substrate 101, the first member 108 comprising a deformable material (i.e. one of a set of solder bumps comprising vanadium-copper, col. 12, line 36 and col. 15, lines 41-43) having a low yield strength and a high elongation to failure and the second member 106 having surface asperities (i.e. not flat surface but trapezoidal cross section) on a surface on a part of the second member 106 to be bonded with the first member 108 (Fig.10); and
- bring the first member 108 into contact with the surface on the second member 106 and pressing the first 108 and the second 106 members against one another using a force sufficient to cause plastic flow of part of the first member 108 into the surface asperities on the second member 106 (i.e. 108 and 106 were squeezed together)(Figs.11-12 and col. 12, lines 36-39).

In re claims 9 and 30, Capot et al. also teach a flip chip interconnection structure made by the method of claims 1 and 22, respectively.

In re claims 18 and 31, Capot et al. also teach that a width of the second member 106 surface is smaller than a width of the first member 108 (Fig.12).

In re claims 19 and 32, Capot et al. also teach that the part of the second member 106 to be bonded with the first member 108 has a generally trapezoidal shape in transverse sectional view, the second surface (i.e. the bottom surface of 106) comprising a plateau having a width smaller than a width of the first member 108 (Fig.12).

In re claims 20 and 33, Capot et al. also teach, prior to pressing the first 108 and second 106 members against one another, dispensing a curable adhesive 109 (i.e. polymer flux) onto a mating surface of the substrate 101 (Fig. 10).

In re claims 21 and 34, Capot et al. also teach, prior to pressing the first 108 and second 106 members against one another, dispensing a curable adhesive 111 (i.e. liquid polymer resin) onto a mating surface of the IC chip 100 (Fig. 10).

In re claims 22, 23, 25, 28 and 29, Capot et al. also teach the claimed method for forming a flip chip interconnection structure, comprising:

- providing a first member 108 on an IC chip 100 and a second member 106 second member 106, which is a surface pad having a plated finish, on a substrate 101, the first member 108 comprising a deformable material having a low yield strength and a high elongation to failure and the second member 106 having a surface adjacent an edge on a part of the second member 106 to be bonded with the first member 108 (Fig. 10); and
- bringing the first member 108 into contact with the second member 106 surface and pressing the first 108 and second 106 members against one another using a force sufficient to cause plastic flow of part of the first member 108 around the edge (Figs. 11-12).

In re claim 35, Capot et al. also teach the second member 106 being provided with asperities on surface thereof (i.e. not flat surface but trapezoidal cross section).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 5 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Capote et al. (US '571) in view of Yuzawa et al. (US 6,335,568).

Capote et al. substantially teaches the claimed method, as stated above, but fails to teach that the second member is a lead. However, Capote et al. further suggest that the teaching is illustrative rather than restrictive and can be modified without departing from the scope and spirit of the invention (col.16, lines 32-39).

In fact, the lead is a very common and necessary member in semiconductor packaging, wherein the lead (i.e. equivalent to the second member) is usually electrically bonded to the bump (i.e. equivalent to the first member) for forming the interconnecting structure, as evidenced by Yuzawa et al. (col. 5, lines 13-40).

Therefore, it would have been obvious to one of the ordinary skill in the art at the time the invention was made to form the flip chip interconnecting structure of Capote et al. with the first member being the deformable material (i.e. the bump) and the second member being the lead, as taught by Yuzawa et al., since by this manner it would be able to plastically deform the lead and to electrically bond the bump for forming the interconnecting structure (col. 5, lines 13-40, Yuzawa et al.).

9. Claims 6 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Capote et al. (US '571) in view of Murakami (US 5,874,780).

Capote et al. substantially teach the claimed method, as stated above, but do not teach that the second member is a via opening.

Murakami, in an analogous art of flip chip interconnect, teach providing a first member 107 (bump) on an IC chip 105 and a second member 118 on a substrate 101/102, and pressing the first 107 and the second 118 members against one another using a force sufficient to cause plastic flow of part of the first member 107 into asperities on the second member 118 (Figs 7B-7C), wherein the second member 118 is a via opening (i.e. a concave opening as shown in Fig. 7A or a via opening of a mounting pad 103 as shown in Fig.3A).

Therefore, it would have been obvious to one of the ordinary skill in the art, at the time the invention was made, to modify the method of Capote et al. by pressing first member of Capote et al. with the second member having the via opening, as taught by Murakami, since by this modification, it would form a flip chip mounting structure having via interconnect.

Response to Arguments

10. Applicant's arguments filed 8/25/03 have been fully considered but they are not persuasive for the reasons as follow.

In re claims 1-4, 6-9 and 18-20, applicant argued that the concave portion of the mounting pad of Murakami cannot constitute "surface asperities" on a part to be bonded because the surface asperities of the instant invention are by jagged lines in sectional views. (second paragraph, page 9).

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e. surface asperities having jagged lines) are **not** recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are **not read into the claims**. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

In fact, the applicant's arguments with respect to claims 1-4, 6-9 and 18-20 are moot in view of the new ground(s) of rejection.

The applicant's arguments with respect to claims 5 and 21-35 are also moot in view of the new ground(s) of rejection in response to the amendment.

Conclusion

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

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12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hsien-Ming Lee whose telephone number is 703-305-7341. The examiner can normally be reached on M-F (9:00 ~ 5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 703-306-2794. The fax phone number for the organization where this application or proceeding is assigned is 703-308-7382.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Hsien-Ming Lee
Examiner
Art Unit 2823

A handwritten signature in black ink, appearing to read 'Hsien-Ming Lee', is written over the printed name and title.

Nov. 10, 2003